

## Blazar PG 1553+113 investigated by researchers

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Multiwavelength light curves of PG 1553+113 covering gamma-ray, X-ray, UV, optical and radio bands with epochs from 2012 to 2020. The gamma-ray light curve is shown with a 20 day binning and the data of X-ray and optical/UV are rebinned to one data point for each observation. Credit: Huang et al., 2021.

Using space observatories and ground-based facilities, Chinese astronomers have investigated a blazar known as PG 1553+113. Results of this study shed more light on the behavior of this object, indicating that it hosts a supermassive black hole binary system. The research was published October 5 on arXiv.org.

Blazars are very compact quasars associated with <u>supermassive black</u> <u>holes</u> (SMBHs) at the centers of active, giant elliptical galaxies. They belong to a larger group of active galaxies that host <u>active galactic nuclei</u> (AGN), and are the most numerous extragalactic gamma-ray sources. Their characteristic features are relativistic jets pointed almost exactly toward the Earth.

At a redshift of 0.5, PG 1553+113 is a blazar showcasing a 2.2-year quasi-periodicity in its gamma-ray light curve. Previous studies of this blazar have suggested that this variability may be related to a jet precession in a SMBH binary system. However, the gamma-ray light curve shows weaker flares near the main ones that might indicate the signs of the twin jets in the system.

Therefore, a team of astronomers led by Shifeng Huang of Shandong University in China decided to investigate the X-ray light curve and spectra of PG 1553+113 observed between 2012 and 2020. They analyzed the data obtained with NASA's Swift and Fermi spacecraft,



ESA's XMM-Newton satellite, as well as the Owens Valley Radio Observatory (OVRO).

"We study the flux and spectral variability of PG 1553+113 on longterm timescales using Swift and XMM-Newton X-ray data collected for the period 2012–2020," the researchers wrote in the paper.

The X-ray light curve of PG 1553+113 exhibits several main and weak flares during the eight-year-long monitoring campaign. It was noted that generally, the main X-ray flares and some weak flares are consistent with the corresponding flares observed on the gamma-ray band. The astronomers observed a "harder-when-brighter" behavior in the X-ray for both main and weak flares, and a "softer-when-brighter" behavior in quiescent states.

According to the paper, the variability in the X-ray band is most likely due to a precession effect of two jets in a supermassive black hole binary system. The astronomers explained that each black hole carries its own jet and the movement of the black holes on the orbit causes the quasiperiodic variation on the light curves.

Based on the results for the X-ray <u>light</u> curve and the correlation between the disk and the jet, the researchers calculated the mass of this SMBH binary system. They found that the primary black hole has a mass of about 347 million solar masses, while the mass of the secondary one is approximately 140 million solar masses, what gives a mass ratio at a level of 0.41.

The authors of the paper added that their results are uncertain and more high cadence observations of PG 1553+113 are required to draw final conclusions regarding the SMBH binary.

More information: Shifeng Huang et al, The X-ray outburst of PG



1553+113: A precession effect of two jets in the supermassive black hole binary system. arXiv:2110.01769v1 [astro-ph.HE], arxiv.org/abs/2110.01769

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